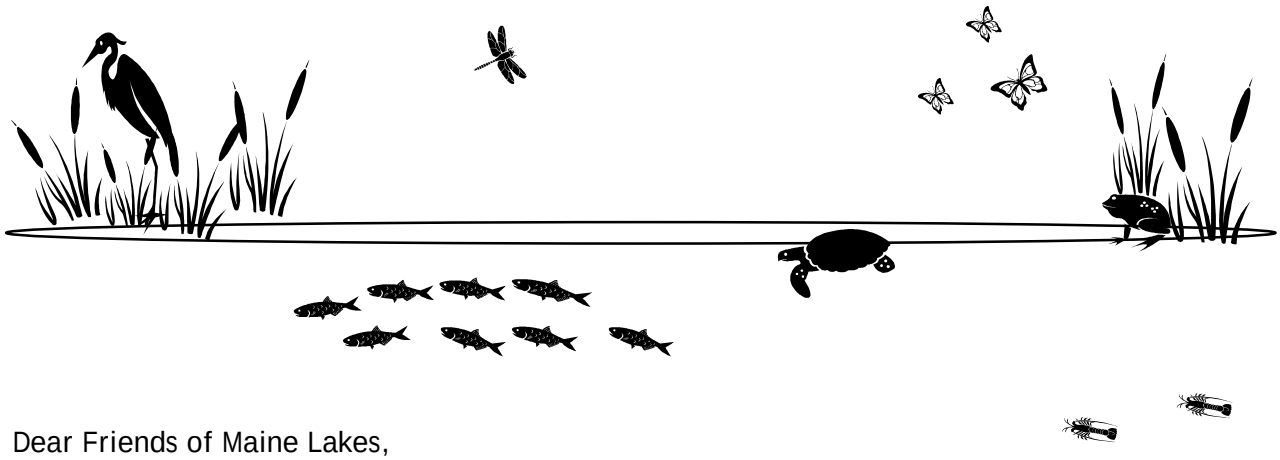


Dear Friends of Maine Lakes,

The 1999 Annual Report for the Maine Volunteer Lake Monitoring Program contains water quality data for over 300 Maine lakes. Forty eight new volunteers, and thirteen new lake were added to the program in 1999. Some of the new volunteers replaced those who retired. Others joined as "alternates" to serve as a backup for existing monitors. The rest joined to provide data from the new lakes.

Each volunteer provides useful information. While it is exciting and valuable to receive data from new lakes, it is equally important to continue to acquire long-term data from lakes that have been in the program for a number of years. Every volunteer monitor makes a valuable contribution that helps us to better understand and protect Maine lakes.

The Annual Report is one of a group of documents produced by the VLMP and the Maine DEP. This report provides annual lake water quality summaries for lakes in the program. More detailed reports for individual lakes are inserted in this document for the volunteers who monitor those lakes. Copies of the individual lake reports are available from the VLMP or DEP. Another publication that is currently being updated is Understanding Maine's Lakes and Ponds. That booklet is concerned primarily with the processes and dynamics of lake ecosystems. It is intended to compliment the data that are presented in this report.

The VLMP continued to work with individuals, organizations and agencies in 1999 to help raise public awareness about the threat of invasive aquatic plants to Maine lakes. This very real threat to our enjoyment of lakes is approaching Maine rapidly. During the next several months, the VLMP will play an important role in the development and implementation of a statewide strategy to prevent the spread of "aquatic invaders" into Maine waters.

The number of dedicated volunteers who have remained active in the VLMP for several years continues to grow, as shown in Appendix E of this report. To each individual lake monitor, the Regional and Data Entry Coordinators, and members of the volunteer Board of Directors – technical advisors - and staff - thanks for all that you have done to make the VLMP an effective organization.

Scott Williams
Executive Director

TABLE OF CONTENTS

APPENDICES

ACKNOWLEDGMENTS

This report was written by Scott Williams .
Many thanks to the following for their assistance:

Script Review:
Linda Bacon
Amy Shnur
Rebecca Welsh

Database/Computer Technical Assistance:
Linda Bacon
Amy Shnur

Cover Design:
Vicki Schmidt

Report Design:
Amy Shnur

Support for this report has been provided by the US Environmental Protection Agency through Section 319 of the Federal Clean Water Act, and by the Maine Department of Environmental Protection.

Staff

Scott Williams, *Executive Director*
Amy Shnur, *Project Coordinator*
Rebecca Welsh, *Development Coordinator*

Board of Directors

Joe Flanagan, *President*
Peter Lowell, *Vice President*
E. James Burke, *Treasurer*
Eileen Burnell, *Secretary*
George Cross
Jean Demetracopoulos
Peter Fischer
Ken Holt
Steve Kahl
Sharon Treat

Maine DEP Technical Advisors

Linda Bacon (Advisor to the VLMP Board)
Roy Bouchard

Agencies and Organizations Working Cooperatively with the VLMP

Maine Department of Environmental Protection
US Environmental Protection Agency
Water Research Institute, University of Maine
Maine Department of Conservation
Maine Department of Inland Fisheries and Wildlife
County Soil and Water Conservation Districts
Lakes Environmental Association
Allagash Wilderness Waterway Commission
Cobbossee Watershed District
Passamaquaddy Indian Nation
Ste. Croix International Waterway Commission
Department of the Interior: Acadia National Park
Lake Associations throughout Maine

Introduction:

Maine has 5,785 lakes and ponds, approximately half of which are in the public domain. Much of the water quality information for these lakes is available through the efforts of volunteers in the VLMP. Good water quality is essential to the recreational, ecological, aesthetic and economic benefits that our lakes provide. Our understanding of the relationship between water quality, watershed land use and the enormous influence of lakes on Maine's economy is just beginning to emerge. Information collected by volunteers in this program has greatly contributed to our understanding of this relationship. In 1999, nearly 350 volunteers collected data on over 300 Maine lakes!

VLMP lake water quality information is collected by trained volunteers who are required to attend periodic recertification workshops in order for their data to be accepted. The majority of volunteers collect transparency (water clarity) data using a Secchi disk and viewing scope. Volunteer monitors are asked to take transparency readings approximately every two weeks, starting in early May, and continuing through September or October. Annual lake water quality determinations and the analysis of long-term trends are dependent on the number of readings taken each summer and the number of complete seasons of data available. Some volunteers also collect dissolved oxygen and chemical data. New directions and dimensions of lake monitoring are being added to the program annually. For example, in 1999 volunteers were provided with information aimed at preventing the spread of invasive aquatic plants in Maine lakes. Several volunteers participated in the monitoring of high elevation lakes to determine the effects of acidified precipitation on lake chemistry.

The VLMP was established in the early 1970's. For many years, the program was administered by the Maine Department of Environmental Protection (DEP), but in 1992, financial support for the program was cut by the Maine Legislature. That loss of funding was an impetus for the program to become an independent nonprofit organization. A strong cooperative, and mutually beneficial relationship, has been maintained between the VLMP and the DEP through the transition. The DEP currently provides quality assurance and quality control standards and guidance to the program, assists with data management, and provides technical support, as needed.

Funding for the VLMP is now provided through grants from the EPA, the Maine DEP, from charitable foundations, and from individuals. However, the greatest *value* of this program is provided by the hundreds of volunteers, who are the backbone of the Program. It has been estimated that the annual value of transparency data alone exceeds $150,000.

Program Purpose and Goals:

The primary goal of the VLMP is to collect, assimilate, and assess information concerning lake water quality for the citizens of Maine, in order to promote protection, education, and planning for Maine's lakes and ponds.

This goal is achieved through scientifically-based lake monitoring and data management in a strong partnership between volunteers and the technical community. An equally important goal of the VLMP is to foster stewardship of lakes and their watersheds by providing education and information to schools, lake associations, town planners, and residents of watershed communities.

Program Structure and Operation:

The VLMP is governed by a volunteer Board of Directors. The Board has approved Bylaws and a Strategic Plan, which guide the program. Annual meetings are held in June of each year. The meetings consist of presentations on lake monitoring and water quality issues, volunteer monitor certification workshops, and a meeting of the Board of Directors. The annual meeting and all Board meetings are open to the public.

The VLMP has been structured to maximize volunteer participation in both data acquisition and program administration. This reduces the cost of operation, increases feedback to the program administrators from the volunteers, and strengthens local stewardship. The State has been divided into regions that follow the boundaries of Maine's 16 counties. Several counties are further broken down into regions to accommodate existing autonomous organizations that collect lake water quality data. Examples of these organizations are the Lakes Environmental Association and the Cobbossee Watershed District.

Each region is administered by a volunteer coordinator, who is the primary contact for volunteers. *Regional Coordinators* assist with the coordination of training and certification workshops, chain of custody tracking of data, providing volunteers with replacement monitoring equipment, and special information/education projects. Each region also has a *Data Entry Coordinator* who enters the information gathered by volunteer monitors in a database that has been designed for the program. Once the data are in an electronic format, the information is sent to the VLMP office where every data entry point is proofed by the VLMP and DEP staff. Coordinators for each region are listed later in this report.

How Are the Data Used?

Data collected by volunteers provide extremely valuable information to researchers, state and town planners, conservation groups, lake associations, economists, and individual citizens. The annual value of the volunteer efforts to gather transparency data alone has been estimated to exceed $150,000. The cost for hiring professional staff to gather and organize this information would be several times higher. This estimate does not take into account the value of other monitoring data (dissolved oxygen, phosphorus, etc.) collected by volunteers on approximately 60 lakes each year. It also does not measure educational benefits that develop from the efforts of individual volunteer monitors who share their experiences and information with lake associations, conservation commissions, planning boards, and local schools.

Recently, volunteer monitors have undertaken yet another valuable public service. They are actively working to prevent the spread of invasive aquatic species in Maine's lakes and ponds.

The potential value to the public from this effort is very high, considering the costs that are involved in efforts to control invasive species, and the lost recreational value that often occurs in infested lakes and ponds.

The following *are just some* of the Maine agencies and organizations that use volunteer lake monitoring data cooperatively for research, education, and planning:

Department of Environmental Protection
US Environmental Protection Agency
Department of Inland Fisheries and Wildlife
County Soil and Water Conservation Districts
Department of Transportation
Department of Conservation/Land Use Regulation Commission
State Planning Office
University of Maine, Orono & Farmington
University of Maine Water Research Institute
Colby College
Bates College
Congress of Lake Associations
Penobscot & Passamaquoddy Indian Nations
Saint Croix International Waterway Commission
Cobbossee Watershed District (Winthrop Region)
Lakes Environmental Association (Bridgton Region)
Numerous individual lake associations
Maine towns and cities
Many public schools

Volunteer lake monitoring data are used for the following purposes:

Research: Trend analysis; lake economic studies; fish habitat assessment; land use analysis studies.

Lake Diagnostic Studies: Evaluating the nature and sources of water quality problems, and exploring solutions.

Lake Restoration Projects: Providing the basis for comprehensive watershed restoration projects and lake restoration efforts.

Lake Protection: Used by town planning boards and conservation commissions; by the Maine DEP for phosphorus control review, determining Lakes Most at Risk for the Maine Stormwater Law; establishing Priority Lake Watersheds; providing data for Maine's Nonpoint Source Program.

Informational/Educational Materials: high schools and colleges; lake associations; the real estate industry; general public.

Quality Assurance and Quality Control:

All data, including volunteer-collected information, are only useful when accurate, of good quality, and reliably collected. In order to ensure that the data collected by the VLMP are scientifically credible, specific technical standards must be met by all that participate in the program. This system of quality assurance is commonly known as QA/QC (quality assurance/ quality control). The VLMP standards of quality assurance are defined in a plan that is approved by the USEPA, which is referred to as a Quality Assurance Project Plan (QAPP). Such a plan is required of any entity that receives funding from the EPA for data collection. It assures those who use the volunteer data that they may do so with confidence.

The primary role of the Maine DEP in the VLMP is to provide QA/QC guidelines and standards for data collection and management. The DEP staff serve as quality control officials, and they provide additional technical support, as required. The VLMP and DEP staff work in a cooperative partnership to ensure that available resources are used efficiently to provide lake protection where it is most needed.

Volunteers who collect transparency data are required to attend a certification workshop every three years (Beginning in the year 2000). Monitors who collect dissolved oxygen data and other indicators of water quality must be certified annually. Workshops are conducted in the field. Monitoring equipment is inspected to verify that everything is in working order and properly calibrated. Volunteers are asked to take readings while an evaluator checks their technique and results. These workshops also provide an opportunity to discuss technical issues, new ideas, and for the volunteers to provide feedback to the staff on the operation of the program.

The program only accepts data from volunteers who are able to meet QA/QC requirements.

This strict rule affirms the credibility of the VLMP as an organization as well as the value and utility of the data. It allows the lake water quality data gathered by our volun-

Interpretation of Transparency Data:

Data gathered by volunteer lake monitors provides valuable information about lake water quality. However, the data must be interpreted with caution, particularly when limited information is available for individual lakes.

Secchi disk transparency readings are used to monitor lake water quality because the procedure is quick, inexpensive, and generally reliable. The primary uses of Secchi transparency data are: 1) to characterize or define the overall water quality of a lake, and 2) to track long-term water quality trends. Both use the amount of algae growing in the water as a primary indicator of water quality. Algal growth in lakes is affected most directly by the concentration of phosphorus in the water, which in turn is influenced by land use in the watershed.

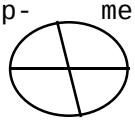
Secchi transparency is an indirect water quality indicator because it is assumed that water clarity is influenced primarily by algal growth. That assumption is reasonable in most cases. However, other factors may also influence transparency, including the amount of sediment that is suspended in the water, and natural water color.

Transparency, or clarity, is the distance that one can see down into a lake.

Transparency is an *indirect* water quality indicator.

This simple test is measured with a Secchi disk and viewing scope.

The Secchi Disk is used globally to assess lake water quality because it is a quick, inexpensive procedure that can be performed by virtually anyone who receives proper training and equipment.



Both of these factors vary from one lake to the next. Natural color is influenced by the concentration of dissolved organic compounds in the lake. These humic acids that leach from vegetation in the watershed can "stain" the water in some lakes to the point where light penetration into the water column is substantially attenuated. Relatively shallow lakes may be periodically subject to high concentrations of sediment in the water column, resulting from wind turbulence. Both color and sediment can reduce the utility of Secchi transparency data.

Lakes undergo natural seasonal and annual cycles that affect transparency. The composition and density of algal communities change throughout the year. Secchi transparency is often reduced in the spring when lake water mixes. The availability of silica from the bottom sediments stimulates diatoms, a type of algae that often experience peak growth in the spring and fall. As lake water warms and stabilizes during the summer, other types of algae typically dominate the water column, depending on water temperature, nutrient levels and other factors.

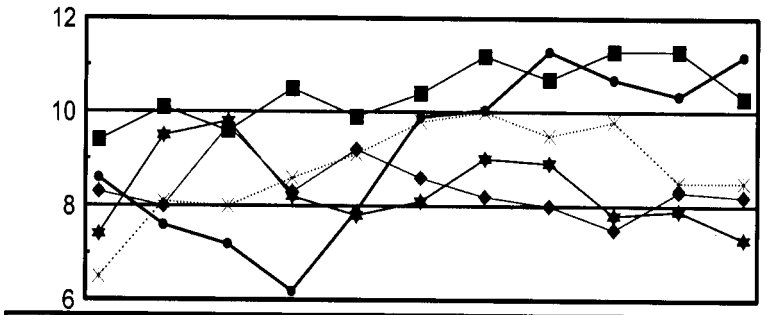
The weather also has a major influence on transparency in many lakes. Strong winds may increase turbidity in the water column, and stormwater runoff from rain and melting snow can carry phosphorus, soil particles and other pollutants into the lake. Some lakes appear to be clearer during periods when there is less runoff, ostensibly because of reduced phosphorus and sediment loading, and less algal growth. Each lake has a unique "personality", resulting in individual responses to the many factors that influence both transparency and overall water quality.

Many Secchi transparency readings are needed over a period of years in order to define and track trends in lake water quality with confidence. Because of the influences of "natural variation" described above, several complete seasons of data are typically required to characterize the quality of individual lakes. For this reason, volunteer lake monitors are asked to collect a minimum of two Secchi disk readings per month from May through September or October every year.

The following graphs illustrate examples of both seasonal and annual transparency variability in a western Maine lake.

Figure 1 shows variation in Secchi transparency readings for the 1995 through 1999 monitoring seasons. Readings were taken approximately every two weeks from May through the middle of October each year. It is worth noting that the monitoring periods in 1995 and 1999 were exceptionally dry and calm. The lowest transparency readings during the five-year period occurred in June 1998, following a very wet spring and an intense two-day rain storm in June. Transparency variation of two meters within individual seasons is common in this lake. In 1998, Secchi transparency varied over five meters.

Transparency in Meters



Year	May		June		July		August		Sept		Oct
1995 ■	9.40	10.10	9.60	10.50	9.90	10.40	11.20	10.70	11.30	11.30	10.30
1996 ✸	7.40	9.50	9.80	8.20	7.80	8.10	9.00	8.90	7.80	7.90	7.30
1997 ◆	8.30	8.00	9.70	8.30	9.20	8.60	8.20	8.00	7.50	8.30	8.20
1998 ●	8.60	7.60	7.20	6.20	7.90	9.90	10.05	11.30	10.70	10.35	11.20
1999 ✳	6.50	8.10	8.00	8.60	9.10	9.80	10.00	9.50	9.80	8.50	8.50

Figure 1

Figure 2 illustrates the annual range in transparency for the same lake over a 22 year period. The Secchi disk in the graph indicates the average transparency for the season. The bars above and below the disk indicate the maximum and minimum Secchi readings for the year. Some of the variation shown in this graph can be correlated with weather events and patterns during individual monitoring seasons. Other variation is probably the result of seasonal changes in the composition, density and location of algal populations in the lake.

Transparency (Clarity) in Meters

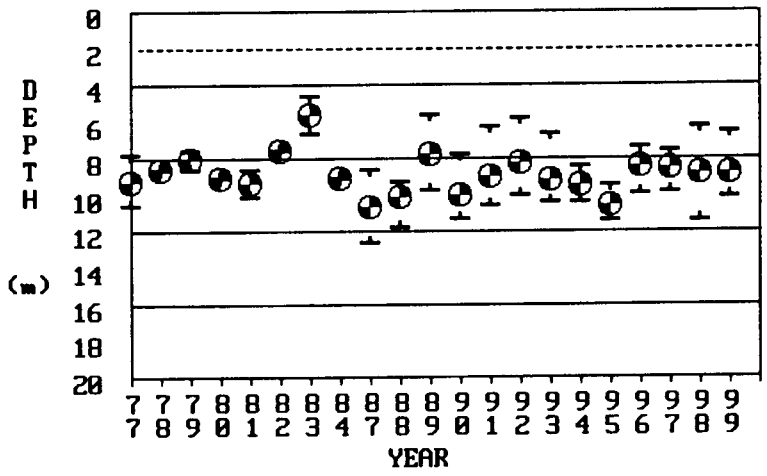


Figure 2

Baseline Lake Data

In addition to volunteer-derived data, the VLMP and DEP strive to gather additional water quality information on a rotating basis for lakes in the program, and other lakes with special concerns. Data gathered include total phosphorus, chlorophyll-a, total alkalinity, color, conductivity, pH, and other chemical and biological information needed for special studies. This additional information provides valuable insight into in-

Joining the VLMP

New volunteer lake monitors are accepted in the VLMP based on the following criteria:

- New volunteers are accepted for lakes where there is presently no monitor. If a volunteer does exist for the lake that you are interested in, you may be trained as an alternate to fill in when the current monitor is not available.
- Lakes that are particularly sensitive, and/or for which there are limited, or no data, receive the highest priority for training new volunteer monitors.
- Volunteers must have access to a boat. Transparency readings should be taken twice a month, starting in May and continuing through September.
- Volunteer monitors who measure transparency must be available to attend re-certification workshops every three years. Volunteers who measure dissolved oxygen and other indicators of water quality must be re-certified annually.
- Volunteers are asked to make a multiple-year commitment to the program.

Additional opportunities to assist in the VLMP include:

Assisting with the Invasive Aquatic Plant Species Prevention Program

Volunteering to be a Regional Coordinator, or Data Entry Coordinator

Assisting with lake ecology and watershed protection education presentations

Volunteering to help with other special projects

If you would like additional information, please write, call, or e-mail:

Maine Volunteer Lake Monitoring Program
PO Box 445
Turner, Maine 04282
207-225-2070

E-mail: *vlmp@megalink.net*

What's New for 2000?

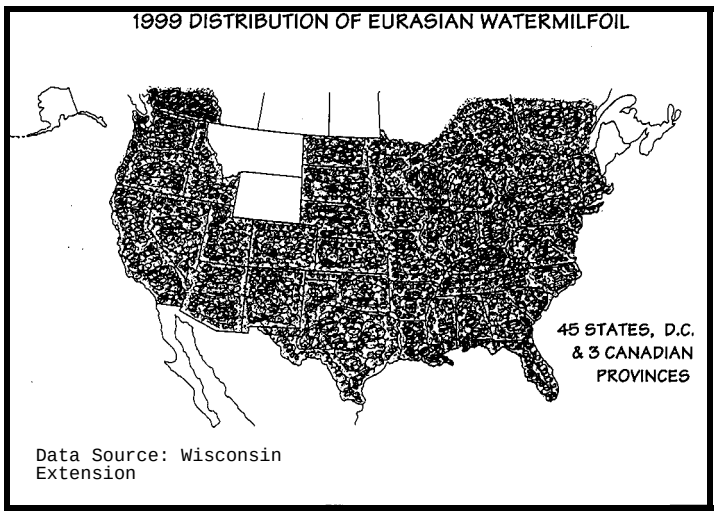
PEARL: Public Educational Access to Resources on Lakes
Lake data and much more is available through PEARL. Lake depth maps, watershed boundaries and educational links are now accessible at this site. Check it out!
www.pearl.spatial.maine.edu

New Volunteers — New Lakes — New Data

The VLMP will expand the number of volunteers and lakes monitored by 10% in 2000. Volunteers who have expressed an interest in monitoring indicators of water quality in addition to Secchi disk transparency will be trained throughout the summer. If you are interested, and you can make the commitment, training is available.

Invasive Aquatic Plant Prevention Program

Aquatic Invaders - Biological Polluters - Nonindigenous Aquatic Plants - no matter what we call these plants, they are **trouble** for Maine lakes. When invasive aquatic plants move into a lake or pond they are there forever! There is no known method to guarantee the eradication of these aggressive species. The map to the right shows just how serious this threat is to Maine lakes. It presents the distribution of Eurasian watermilfoil in the U.S. as of 1999. Maine may now be the only state in the Country that has not been infested with this highly aggressive and destructive plant.



What Are We Doing About This Problem?

The VLMP continues to work with the DEP and the Maine Outdoor Heritage Fund to raise public awareness about this serious threat. The following actions are being taken in 2000:

~ **Volunteer monitors, VLMP and State Agency staff will continue to post warning signs at public boat landings.**

~ **Warning signs will be erected at all major entry roads to the State of Maine.**

~ **VLMP and the DEP are providing information to the Natural Resources Committee of the Maine Legislature to pass emergency legislation that would prohibit the introduction of invasive aquatic species to Maine waters. If this legislation passes, it will be illegal to transport *any* aquatic plant on a vehicle on public roads!**

~ VLMP cosponsored the Maine Milfoil Summit - at which strategies to protect Maine from aquatic invaders were discussed by a broad group of agencies and organizations.

~ Public Service Announcements will be developed to warn people about this

dices

Appendix A

1999 Distribution of Water Quality Data for Maine Lakes

The data illustrated in Appendix A are based on average annual values for all of the available summary lake water quality data for Maine lakes. The majority of the transparency data, and some of the dissolved oxygen data, were collected by VLMP volunteers. The remainder is from several sources, including the Maine DEP, VLMP staff, water quality agencies and organizations listed elsewhere in this publication, and consultants. Every effort has been made to ensure that the data are accurate and credible.

Appendix A contains histograms (a graph that shows how the data values are distributed for a particular variable) of the indicators of lake water quality for the lakes that have been included in each data set. The number of lakes sampled varies for each lake quality indicator. The range of values, the average, and the number of lakes sampled are shown with each graph.

As you view this information, please be aware that lake water quality varies from year to year, and that a number of years of consistent data are needed to characterize a lake, and to detect long-term trends. The distribution of data in the graphs will show very little change from year to year, because of the cumulative nature of the information that is being illustrated. However, water quality indicators for the individual lakes may show substantial annual variation.

Lake water quality indicators illustrated in Appendix A:

Transparency: A measure of water clarity. Factors that reduce clarity include algal growth, zooplankton, natural water color, and silt/sediment. Because algae are the most abundant particles in most lakes, transparency indirectly measures algal growth. Transparency values vary widely in Maine lakes. Unless a lake is highly colored or turbid from suspended sediment, transparency readings of 2 meters or less indicate an algal bloom.

Total Phosphorus: Total phosphorus is a measure of all forms of phosphorus (organic and inorganic) in the water. Phosphorus is one of the major nutrients needed for plant growth. Because its natural occurrence in lakes is in very small amounts, phosphorus "limits" the growth of plants in the lake ecosystem. Excess phosphorus in lake water can cause substantial increases in algae growth. Phosphorus is measured in parts per billion (ppb). Its concentration may be based on samples taken from the surface of the lake or from discrete samples taken at specific depths, or from an integrated water column sample.

Chlorophyll a: Chlorophyll a is a pigment found in algae and other plants. By measuring the concentration of CHL in lake water, the algae population can be estimated. CHL is measured in parts per billion (ppb).

Chlorophyll a samples are generally obtained from an integrated water column sample because the greatest concentration of algal growth typically occurs from the surface of the lake to a depth of several meters.

Transparency, total phosphorus, and chlorophyll a are sometimes referred to as "trophic state" indicators, or indicators of biological productivity in the lake ecosystem. The following table equates general levels of productivity for Maine lakes with levels or concentrations of the three trophic state indicators:

Level of Productivity	Transparency (Meters)	Total Phosphorus (parts per billion)	Chlorophyll a (parts per billion)
Low	**7.1, or higher**	**5.0, or less**	**2.0, or less**
Moderate	**4.1 -7.0**	**5.1 -10.0**	**2.1-7.0**
High	**4.0, or less**	**10.1, or more**	**7.1, or more**

Alkalinity: Alkalinity is a measure of the capacity of water to neutralize acids. It is also referred to as "buffering capacity". It is a measure primarily of naturally available bicarbonate, carbonate, and hydroxide ions in the water. Alkalinity is measured in milligrams per liter (mg/l).

pH: The pH of a lake reflects how acidic or basic the water is. pH helps determine which plant and animal species can live in the lake, and how biochemical processes proceed. The pH scale ranges from 0-14, with 7 being neutral. Water is increasingly acidic below 7, and increasingly alkaline above 7. A one unit change in pH represents a tenfold change in acidity or alkalinity. The pH scale is the inverse log of the hydrogen ion concentration.

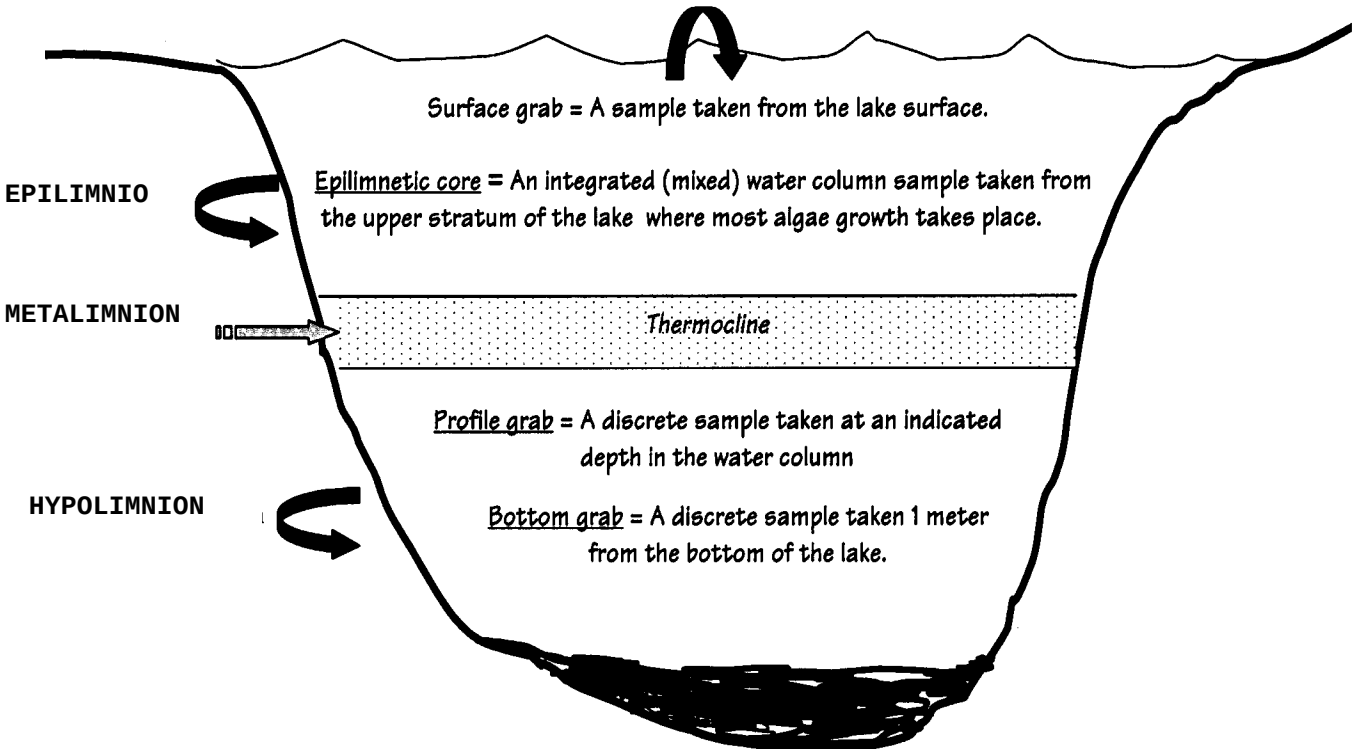
Apparent Color: Color generally refers to the concentration of natural dissolved organic acids in lake water. These "humic" acids leach from vegetation in the lake watershed. Color is measured in Standard Platinum Units (SPU). Lakes with color levels greater than 25 SPU are considered moderately colored. This can cause transparency to be reduced, and phosphorus levels to be elevated. The water in highly colored lakes often has the appearance of a cup of tea. When lakes are highly colored, the best indicator of algal growth is Chlorophyll a.

Specific Conductance: Conductivity is a measure of the ability of water to carry an electrical current. It is directly related to the level of dissolved ions in the water. Conductivity levels will increase if there is an increase in the concentration of pollutants in the water. Conductivity is measured in micro-siemins per centimeter (µ/cm).

Trophic State Index: The term "trophic status" refers to the level of biological productivity in a lake. The Trophic State Index (TSI) was developed in 1997 by Robert Carlson as a means to be used for establishing a simple numerical relationship between the three commonly designated trophic state indicators (transparency, total phosphorus, and chlorophyll a). The statistical TSI models developed by Carlson have been modified for Maine lakes, based on historical water quality data. The TSI converts raw data from the indicators of productivity to a standard numerical scale. The scale ranges from 0 to over 100. An increase in TSI indicates an increase in overall productivity, and typically poorer water quality.

Sampling Methods:

The following methods are commonly used to sample lake water quality:



Appendix B

1999 Data Listing for Individual Lakes

Appendix B lists transparency data for lakes participating in the VLMP in 1999. The availability of additional historical water quality data for individual lakes is indicated by a "Y" for specific indicators/ parameters. Data summaries for these additional parameters is available in individual lake reports, which may be obtained from the Maine DEP or the VLMP. The lakes are listed alphabetically for each county. The following key explains Appendix B column headings:

KEY TO WATER QUALITY DATA LISTING FOR INDIVIDUAL LAKES:

- MIDAS: Unique four digit identification code for a lake**.**
- STA: Refers to the sample station number on the lake. Most lakes have only one station. That sample station location is generally located at the deepest spot in the lake. Some lakes have
- multiple stations, especially those lakes with more than one "true basin".
- COUNTY: in which the indicated station number is located.
- TOWN: in which the indicated station number is located.

SECCHI TRANSPARENCY

- AVE: The average Secchi transparency in meters
- B: Indicates that average transparency reading was the bottom of the lake
- MIN: The minimum (lowest) transparency reading for the season
- B: Indicates that the minimum transparency reading hit the lake bottom
- MAX: Maximum (highest) transparency reading in meters.
- B: Maximum transparency hit the lake bottom.
- N: Number of months of transparency data used to calculate the average.

Note: For lakes where one, or more Secchi disk readings "hit bottom", transparency is generally underestimated. The data still have value, but transparency may not be an accurate method for estimating biological productivity in these lakes.

HISTORICAL DATA AVAILABLE FOR

- DO: Indicates dissolved oxygen data are available
- TP: Indicates total phosphorus data are available
- CHL: Indicates chlorophyll-a data are available
- pH: Indicates pH data are available.
- ALK: Indicates total alkalinity data are available.
- COL: Indicates color data are available.
- CON: Indicates conductivity data are available.

LAKE LISTS

- PW: Indicates that the lake is on the MDEP Nonpoint Source Priority Watershed List. The PW list consists of 181 lakes out of 2314 significant lakes in Maine. All of the lakes on this list have water quality that is either impaired, or threatened to some degree from nonpoint source pollution (polluted runoff) from land use activities in the watershed. These lakes have significant value from a regional perspective. Forty-one of the Priority Watershed lakes (boldface) are listed as "higher priority". These lakes have significant value from a statewide perspective.
- LAR: Indicates Lakes Most at Risk. This is a designation used in the Maine Stormwater Management Law that provides a higher level of protection from stormwater runoff for the lakes listed.

This designation only applies to activities in a lake watershed that are subject to the provisions of the Stormwater Management Law.

- ATT, SW, AL & TS: All states are required to evaluate the status of their lakes and report these results to the Environmental Protection Agency under the Clean Water Act. Maine's Water Classification Program (M.R.S.A. Title 38, Article 4-A, Section 465-A) requires that the waters in Maine's Lakes and Ponds be suitable for a number of "designated uses", including the condition of having a "stable or decreasing trophic state" (Trophic state is a measure of biological productivity. Secchi disk

readings indirectly measure trophic state. If Secchi readings improve, or chlorophyll-a concentrations decline, biological productivity and trophic state are decreasing).

The degree to which a lake meets these "designated uses" is called the lake's "Attainment Status". In addition, each lake is assigned an "Overall Attainment Status" that reflects the support of all designations. The last four columns in Appendix B display Overall Attainment Status (ATT), and the Attainment Status of the designated uses of Swimming (SW), Aquatic Life Support (AL) and the condition of Trophic Stability (TS).

The Attainment Status for each of these categories is listed as one of the following:

FS= Fully Supporting
FT= Fully Supporting but Threatened
PS= Partially Supporting

A lake having the Fully Supporting designation is "in attainment" of its classified use, or the specific designated use. A lake that has experienced repeated nuisance algal blooms is considered as Partially Supporting the designated use of Swimming. Likewise, a lake that supports a coldwater fishery is considered Partially Supporting the designated use of Aquatic Life support if it develops a significant dissolved oxygen loss in its deep waters during late summer. A lake that has extreme water level fluctuations is also considered as Partially Supporting for Aquatic Life. If a lake is observed to have a deteriorating trophic state, it is considered as Partially Supporting the Trophic Stability designation. Lakes that only Partially Support a designated use are considered to be in "Non-attainment", i.e., they are not attaining their classification.

There are a number of reasons why a lake may be considered as Fully Supporting but Threatened (a/k/a Threatened). For example, if lake vulnerability modeling predicts that the lake could experience a 1ppb increase in total phosphorous over the next 50 years, and the lake is not already Partially Supporting Swimming or Trophic Stability, it is likely to be considered Threatened for those uses. If a lake has experienced one algal bloom, it would be considered Threatened for Swimming and Trophic Stability. Likewise, if it appears that there is a declining water quality trend but evidence is inconclusive, the lake would be considered Threatened for Trophic Stability.

The criteria used to determine attainment status for each use is determined by the DEP and can be found in their 1999 Water Quality Assessment Report when available. It is important to note that all lakes in Maine only Partially Support the designated use of Fish Consumption because of the fish consumption advisory currently in effect. Also of note is that all lakes Fully Support the designated uses of Drinking Water (after disinfection), Recreation (in and on), Industrial Processes, Cooling Water Supply, Hydroelectric Power Generation, and Navigation.

Appendix C:

Range of 1999 Average Secchi Transparency for VLMP Lakes

The following is a listing of the average annual Secchi transparency values in 1999 for VLMP lakes, arranged from the lowest to the highest values. Please refer to the key below:

Mean: Annual average Secchi transparency

Midas: Unique four digit identification code for lakes

Station: Refers to the sample station number where the reading was taken

County: in which the reading was taken

Town: in which the reading was taken

***** : Some, or all transparency readings were limited by the depth of the lake

Appendix D

1999 Regional and Data Entry Coordinators

Appendix D lists Regional and Data Entry Coordinators for the VLMP in 1998. *Please note that volunteers are needed for some positions in 2000.* Anyone who is interested in serving as a Coordinator should contact the VLMP office for additional information concerning these volunteer positions. Both Regional and Data Entry Coordinators can expect to commit a minimum of 25 hours per year to the program.

County or Agency	Regional Coordinator	Data Entry Coordinator
Androscoggin	Ken Holt	Alan Anderson
Aroostook	Sarah Beasley	Sharon Eastman
Cumberland	Charles Turner	Amy Stratford
Franklin	Peg Morrill	Peg Morrill
Hancock	Joe Flanagan	Richard Offinger
Kennebec	VLMP ***Volunteer Needed**	VLMP
Knox	Bill Gould	Stan Wood
Lincoln	Peter Fischer	Steve O'Bryan
Oxford	Art Bubar	Joe Potts
Penobscot	Sue Harvey	David Hodsdon
Piscataquis	Peter Devine	Richard Offinger
Sagadahoc	Peter Fischer	Steve O'Bryan
Somerset	Peg Morrill	Alan Anderson
Waldo	Mary Hitchings	Stan Wood
Washington	*VLMP* ***Volunteer Needed**	Richard Offinger
York	George Bouchard	Anita Weidnecht
Acadia National Park	Bill Gawley	Bill Gawley
Allagash Waterway	Marilyn Dailey	Sharon Eastman
Cobbossee Watershed Dist.	Jeremy Martin	Jeremy Martin
Lakes Environmental Association	Susan Breau	Angie Miles
Passamaquoddy Indian Nation	Julie Coffin	Julie Coffin
St. Croix International Waterway Commission	Lee Sochasky	Lee Sochasky

Appendix E

1999 Volunteer Lake Monitors

Appendix E is a chronological listing of all volunteer lake monitors in the VLMP in 1999. The list begins with those individuals who have been with the program longest, and ends with those who joined in 1999. Attrition within the VLMP is relatively low. In 1999, a large number of volunteers joined the program, due in part to improved funding and staffing.

Years of Service

Ross Swain collects dissolved oxygen data on Roxbury Pond

Malcolm Brown canoes to a training workshop on Arnold Brook Lake

Kent Mitchell and Ken Holt collect total phosphorus samples on Bear Pond

~ New species have been added to the list of problem plants. The list now includes:

Eurasian watermilfoil (*Myriophyllum spicatum)*

Variable-leaf watermilfoil *(Myriophyllum heterophyllum)*

Water Chestnut *(Trapa natans)*

Hydrilla *(Hydrilla verticilatta)*

Fanwort *(Cabomba caroliniana)*

Curly-pondweed *(Potamogeton crispus)*

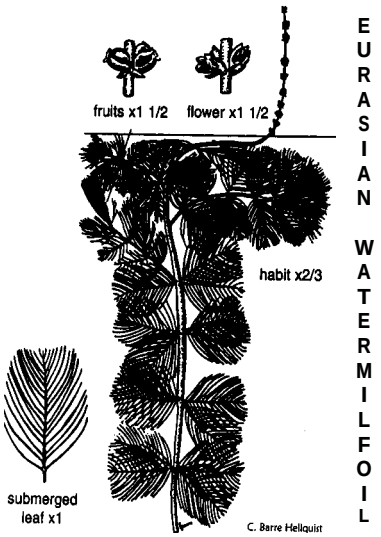
Parrot feather *(Myriophyllum aquaticum)*

European naiad *(Najas minor)*

Brazilian elodea *(Egeria densa)*

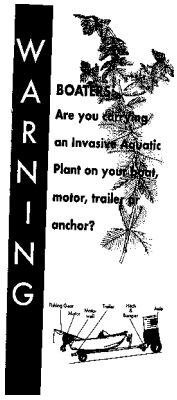
Frogbit *(Hydrocharis morsus-ranae)*

Yellow floating heart *(Nymphoides peltata)*



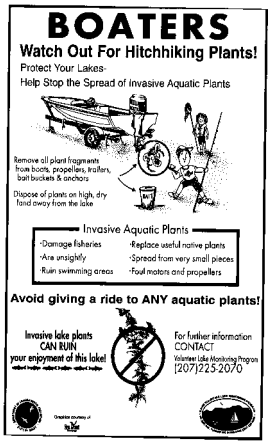
YOU CAN HELP!

Volunteer monitors can play a vital role in protecting Maine lakes from these invaders. Consider helping with the VLMP prevention efforts by doing the following:



- Make sure that public boat landings are posted with warning signs.

- Distribute "Warning to Boaters" flyers to your town office to distribute with boat registrations and fishing licenses.



- Distribute educational materials at lake association meetings; fish and game clubs; town conservation commissions, etc.

- Write an article for your local newspaper.

- Become a certified "Problem Plant Preventor" by attending training workshops through the VLMP.

1999 Weather Influences on Maine Lakes

The weather during the 1999 lake monitoring season was unusual throughout much of Maine. The spring through mid-summer period was exceptionally dry and warm. This period was also very sunny. As a result, lake water surface temperatures were warmer than average for many lakes, especially in Southern and Western Maine. Table 1 is a summary of information obtained by the National Weather Service in Portland. Although the meteorological data on which the summaries are based is from the Portland and Gray area, the general conditions cited existed throughout much of the State.

1999 Weather Summary Information from Portland, Maine

Month	Precipitation	Temperature	Sunshine	Comments
April	0.28 inches total Driest April in 29 years	Above average	18 days were "mostly sunny"	28th least snowy winter in 118 years
May	4.98 inches Slightly wetter than average	Above average	19 days were "mostly sunny"	Warmest winter/spring in 59 years
June	0.95 inches 8th driest in 129 years	Warmest June in 59 years	18 days were "mostly sunny"	Jan-June 3rd warmest period in 59 years
July	1.62 inches 13th driest in 129 years	3rd warmest July in 59 years	21 days "mostly sunny" sunshine every day of June and July	2nd driest period in 129 years. Jan-July was the warmest such period in 59 years
August	1.53 inches 24th driest in 129 years	Warmer than average	22 days were "mostly sunny"	Driest summer in 129 years in Portland

Table 1

Without precipitation, there is little stormwater runoff from lake watersheds. Stormwater runoff is the primary means by which phosphorus enters lakes. Phosphorus concentrations in runoff from developed areas is generally much higher than runoff from natural forested land. It is therefore reasonable to assume that the reduced runoff in the spring and early summer would result in lower than normal phosphorus loading to many Maine lakes. The anticipated effect would be less algal growth and higher Secchi disk readings, even though water temperatures were relatively high, and there was ample sunlight. *A review of the Secchi disk transparency data for 24 lakes situated in the central-southwestern region of Maine showed that all but two of the lakes were as clear as, or clearer than the long-term Secchi average for each lake. One quarter of these lakes were the clearest that they have been since transparency records have been kept.*

There appears to be a message here: If stormwater runoff from developed areas of lake watersheds can be minimized, or treated before it reaches the lake, it may be possible to keep lakes clear from excess algae growth.

For most lakes, the primary influence on Secchi transparency is the relative abundance of planktonic algae in the water. The 1999 weather may have limited planktonic algal growth in many Maine lakes. However, the warm water temperatures and abundant sunlight appears to have stimulated another type of algae. Metaphyton are the thread-like, or "green cotton candy" algae that grow in relatively shallow areas of lakes. Metaphyton may form large floating clouds, or they may become attached to rooted plant stalks or debris in the water. These algae may be somewhat less dependent on phosphorus from runoff than the planktonic species. They tend to proliferate during warm, sunny periods. Many reports of excess metaphyton growth were received by the VLMP and DEP last summer, ostensibly due to the weather.

Over 25 years of Commitment to Maine Lakes & Ponds

For additional information concerning invasive aquatic plant prevention or other lake water quality issues,

Maine Volunteer Lake
Monitoring Program
P.O. Box 445
Turner, Maine 04282

Maine Department Of
Environmental Protection
State House Station 17
Augusta, Maine 04333

email: vlmp@megalink.net

for VLMP information online:, Visit the DEP or Water Research Institute website

www.state.me.us/dep/blwq/lake.htm

www.umaine.edu/waterresearch